

Body Dimensions of Pygmy Whitefish (*Prosopium coulteri*) Chester Morse Lake/Cedar River Municipal Watershed – December 2007

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Purpose

The primary intent of the study effort described below is to provide specific, on-site information on body size/conformation of pygmy whitefish (*Prosopium coulteri*) that utilize the Chester Morse Lake/Masonry Pool reservoir complex using individuals captured in the Cedar/Rex rivers during the spawning season. The study also directly informs other biologists, SPU water supply managers, and consultants of these body measurements relative specifically to the planning and design of 'fish screens' for the intake structure of the pumping plant currently being designed for future installation and use in Chester Morse Lake reservoir.

Background

Pygmy whitefish, a relic species and a major prey item of federally listed (threatened) bull trout (*Salvelinus confluentus*), resides in the Chester Morse Lake/Masonry Pool reservoir complex throughout the year. During a relatively short 3-week period of time in December, however, substantial numbers (i.e., thousands) of reproductively mature individuals migrate into the lower reaches of major tributaries of Chester Morse Lake (e.g., Cedar and Rex rivers) to spawn. Pygmy whitefish are broadcast spawners (as opposed to most other salmonids that join as a pair and construct redds) and while in tributary streams to spawn, are usually found in large schools that typically number in the hundreds of individuals, including both males and females. This pattern of behavior lends itself both to ease of observation and to relatively benign capture with no or only minimal risk of associated injury or mortality.

Methods

In December 2007, SPU Fish and Wildlife Unit staff with assistance from Forest and Channel Metrics, Inc. consultants captured several hundred pygmy whitefish (n = 1,803) from several schools located in the Cedar and Rex rivers using beach seines and large dip nets. Certain body measurements were taken from a sub-sample (approximately 24%) of captured fish in order to assess variation in body size/shape of reproductive age fish and to generate representative cross-sectional profiles for males, females, and all fish combined (see p. 2). All fish included in the sub-sample measured, including the smallest individuals of each sex, were reproductively mature, adult fish in spawning condition (no juvenile fish in sample). Body depth and width were measured immediately anterior to the dorsal fin and length was measured as fork length (nose to 'notch' in the caudal fin. Results are presented on p. 2 and 3 below.

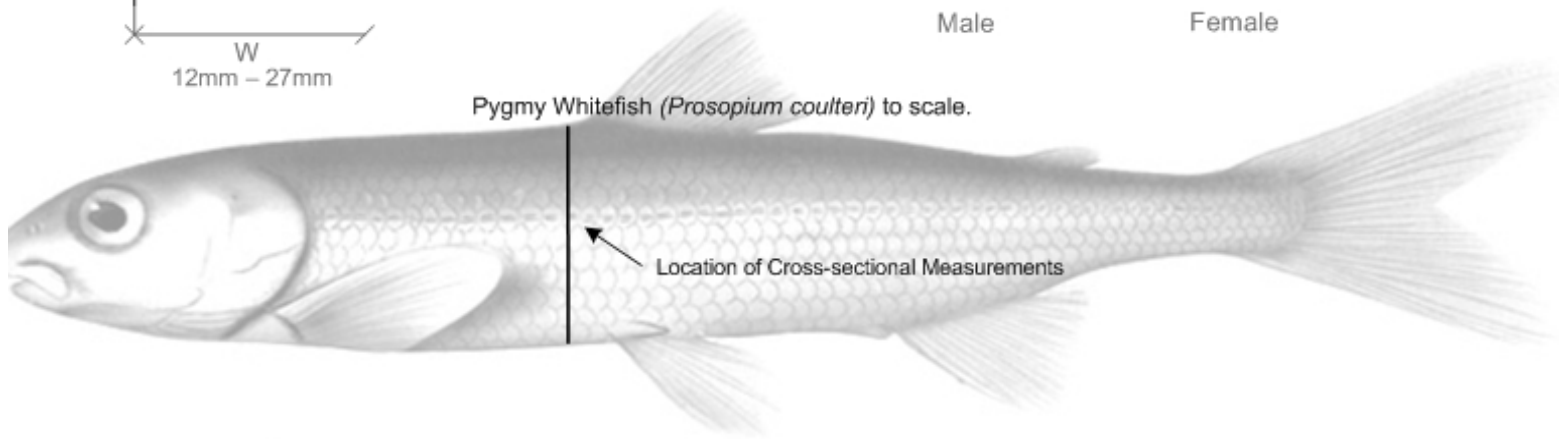
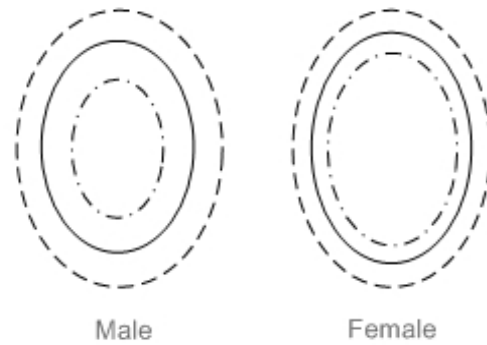
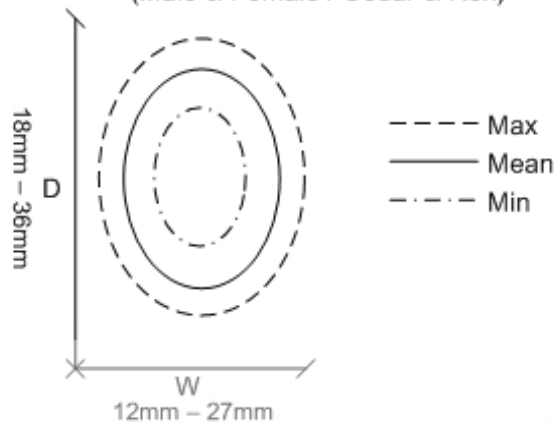
Discussion

The head of pygmy whitefish (anterior to the operculum) is slightly smaller in both depth and width than the site where measurements were taken in this study (see diagram). Taking similar measurements in the head area (anterior to the operculum) would increase risk to sensitive organs and such measurements would be substantially less consistent. A screen mesh size that would allow the head of the fish through, posterior to the operculum, despite not allowing passage of the entire body, would essentially entrain the fish. A fish would usually not be able to 'back out' from that point and mortality would probably result. Therefore, screen design (i.e., mesh size) should be 'extrapolated' from the body dimensions presented here (see p. 3) and be equal to or less than the minimal cross-sectional profile dimension (i.e., 11mm for average sized pygmy whitefish). ***To screen for juvenile bull trout, mesh size would need to be smaller than 11mm and likely comparable to the smallest adult pygmy whitefish recorded (i.e., 6.7mm mesh size).***

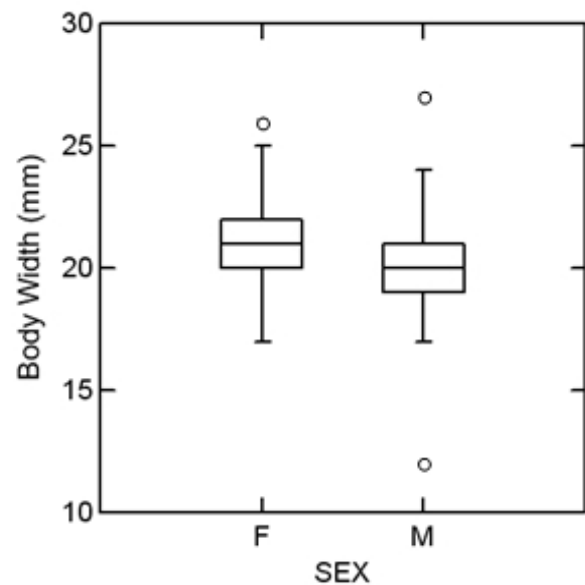
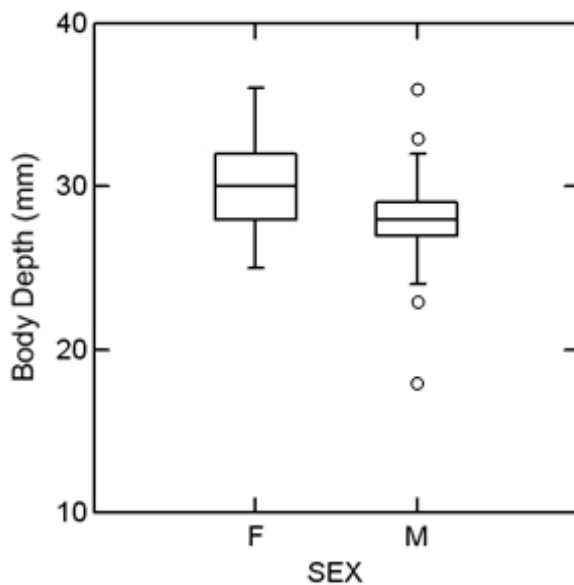
Pygmy Whitefish Cross-sectional Dimensions

Cross-section (to scale) of All Fish
(Male & Female / Cedar & Rex)

Cross-section (to scale)
of Male & Female Fish

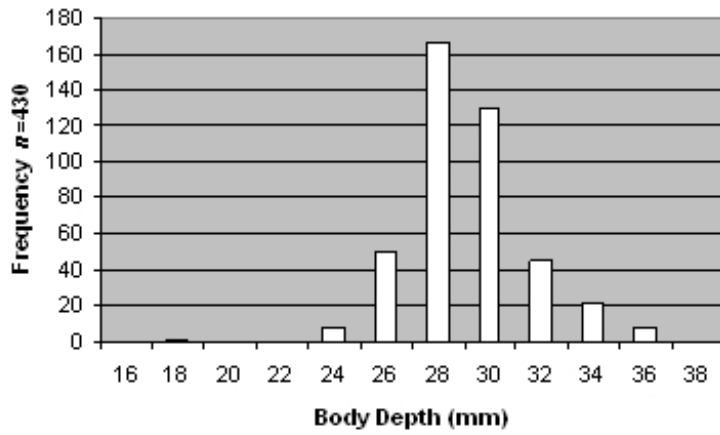


	All Fish	Male	Female
Depth $n =$	430	272	158
Max D(mm)	36	36	36
Mean D(mm)	28.5	28	30
Min D(mm)	18	18	25
Width $n =$	306	148	158
Max W(mm)	27	27	26
Mean W(mm)	20.5	20	21
Min W(mm)	12	12	17

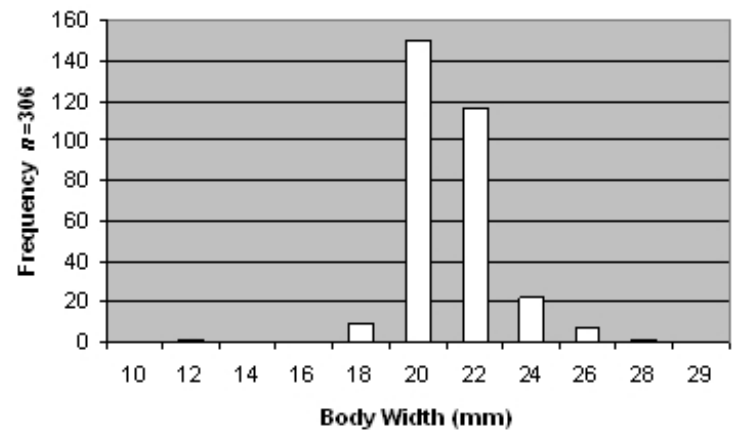


The box itself contains 50% of the sample. The line within the box represents the mean value. The ends of the vertical lines or "whiskers" indicate the minimum and maximum values unless outliers are present. Outliers are represented by a small circle.

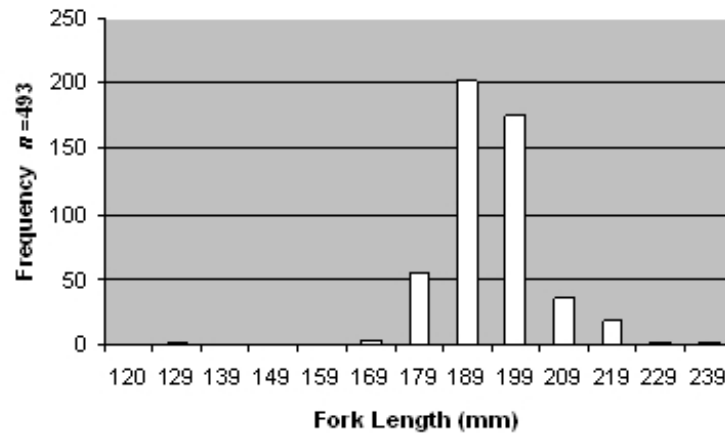
Pygmy Whitefish Body Depth (All Fish)



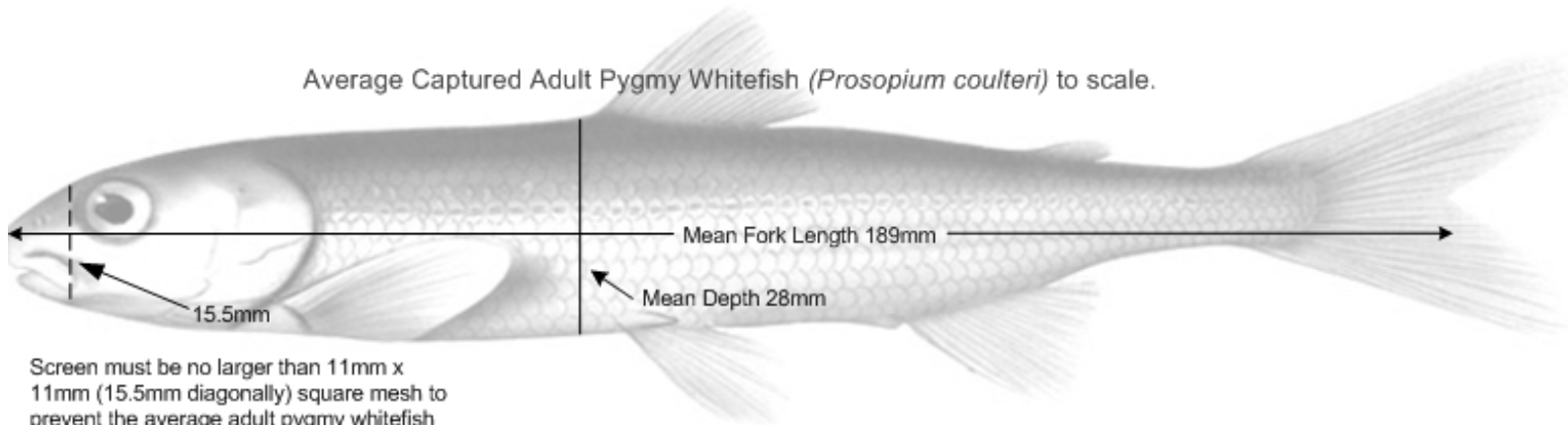
Pygmy Whitefish Body Width (All Fish)



Pygmy Whitefish Fork Length (All Fish)

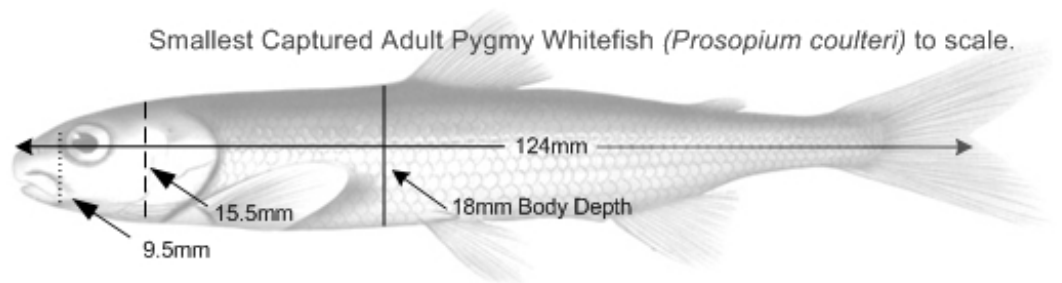


Average Captured Adult Pygmy Whitefish (*Prosopium coulteri*) to scale.



Screen must be no larger than 11mm x 11mm (15.5mm diagonally) square mesh to prevent the average adult pygmy whitefish from potential entrapment in mesh.

Smallest Captured Adult Pygmy Whitefish (*Prosopium coulteri*) to scale.



Screen must be no larger than 6.7mm x 6.7mm (9.5mm diagonally) square mesh to prevent the smallest adult pygmy whitefish from potential entrapment in mesh.